MECHANICAL-PROPERTY DATA 7175 ALUMINUM

T736 Forging

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Air Force Materials Laboratory
Air Force Systems Command
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Prepared by

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This data sheet was prepared by Battelle Memorial Institute under Contract F33615-69-C-1115. The contract was initiated under Project No. 7381, "Materials Application", Task No. 738106, "Engineering and Design Data". The major objectives of this program are to evaluate newly developed structural materials of potential Air Force weapons-system interest and then to provide data-sheet-type presentations of these data. The program was assigned to the Structural Materials Engineering Division at Battelle under the technical supervision of Mr. Walter S. Hyler. Project engineer was Mr. Omar Deel. The program was administered under the direction of the Air Force Materials Laboratory, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, by Mr. Marvin Knight, project engineer.

Notices

7175 Aluminum Alloy

7175 is a new Premium Strength Die Forging developed by Alcoa. This development is intended to provide relatively high strength/weight ratios for aerospace applications. The guaranteed minimum longitudinal yield strength for the -T736 temper is approximately 17 percent above the current minimum requirements of specifications covering 7075 alloy die forgings in the -T73 temper. Although the development emphasis was placed on high longitudinal strength, the transverse ductility is also well above that of most conventional 7075 die forgings.

Tests on a limited number of forgings (by Alcoa) in the -T736 temper indicate that the stress-corrosion cracking threshold in the short transverse direction should be at least 35 ksi.

Currently, the product is limited to closed die airframe-type forgings.

7175 Aluminum[a]
Condition: -T736
Thickness: Various (Die Forging)

Properties	Temperature, F			
	RT	250	350	500
Tension				
F_{tu} (longitudinal), ksi	82.0	66.3	52.8	19.7
F_{tu} (transverse), ksi	79.2	64.2	50.7	19.2
F_{ty} (longitudinal), ksi	75.4	66.2	52.6	19.7
F_{ty} (transverse), ksi	72.3	64.0	50.4	19.2
e_t (longitudinal), percent in 2 in.	14.3	21.0	23.3	29.0
e_t (transverse), percent in 2 in.	12.3	16.0	21.0	26.3
RA (longitudinal), percent	36.8	52.8	67.0	91.5
RA (transverse), percent	35.8	47.2	62.9	91.0
E_t (longitudinal), 10^6 psi	10.3	9.7	8.6	8.2
E_t (transverse), 10^6 psi	10.0	9.5	8.5	8.3
Compression				
F_{cy} (longitudinal), ksi	78.8	69.8	57.1	22.2
F_{cy} (transverse), ksi	74.0	65.5	54.8	21.8
E_c (longitudinal), 10^6 psi	11.0	10.1	8.9	8.0
E_c (transverse), 10^6 psi	10.7	9.9	9.3	7.6
Shear[b]				
F_{su} (longitudinal), ksi	47.5	U[c]	U	U
F_{su} (transverse), ksi	49.7	U	U	U
Impact (V-Notch Charpy)				
Energy (longitudinal), ft-lb	6.2[d]	U	U	U
Energy (transverse), ft-lb	5.3	U	U	U
Fracture Toughness, K_{Ic}, ksi$\sqrt{in}$	48.5[e]	U	U	U

Properties	Temperature, F			
	RT	250	350	500
Fatigue (longitudinal)[f]				
Unnotched, R = 0.1				
10^5 cycles, ksi	82	80	68	U
10^6 cycles, ksi	63	58	50	U
10^7 cycles, ksi	34	33	28	U
Notched (K_t = 3.0), R = 0.1				
10^5 cycles, ksi	58	50	47	U
10^6 cycles, ksi	27	24	22	U
10^7 cycles, ksi	15	14	13	U
Creep (longitudinal)				
0.2% plastic deformation, 100 hr	NA	45	18	4.5
0.2% plastic deformation, 1000 hr	NA	40	12	3.0
Stress Rupture				
Rupture 100 hr	NA	51	23	6.5
Rupture 1000 hr	NA	44	15.5	4.7
Stress Corrosion				
80% F_{ty}, 1000 hr max	No cracks[g]			
Coefficient of Thermal Expansion				
12.5×10^{-6} in/in/F (68 – 250 F)				
Density 0.101 lb/in^3				

(a) Each value given is the average of at least three tests conducted at Battelle under the subject contract unless otherwise indicated. Fatigue, creep, and stress-rupture values are from curves generated using a greater number of tests.

(b) Double-shear pin-type specimen, 0.250-inch diameter.

(c) U, unavailable; NA, not applicable

(d) Longitudinal at -100 F = 4.5
Transverse at -100 F = 4.0
Longitudinal at -320 F = 4.5
Transverse at -320 F = 3.5
Each value is average of three tests at temperature indicated.

(e) Average of six slow bend tests.

(f) "R" represents the algebraic ratio of minimum stress to maximum stress in one cycle; that is, $R = S_{min}/S_{max}$. "K_t" represents the Neuber-Peterson theoretical stress-concentration factor.

(g) Room temperature three-point bend test. Alternate immersion in 3-1/2% NaCl.

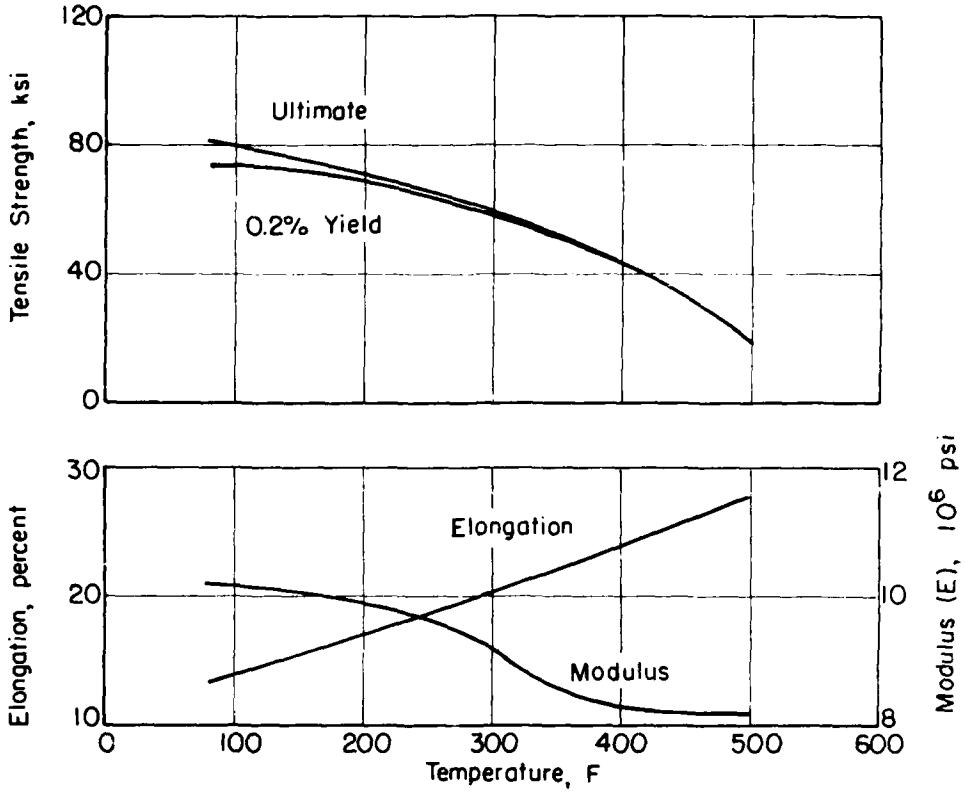

FIGURE 1. EFFECT OF TEMPERATURE ON THE TENSILE PROPERTIES OF 7175-T736 DIE FORGING

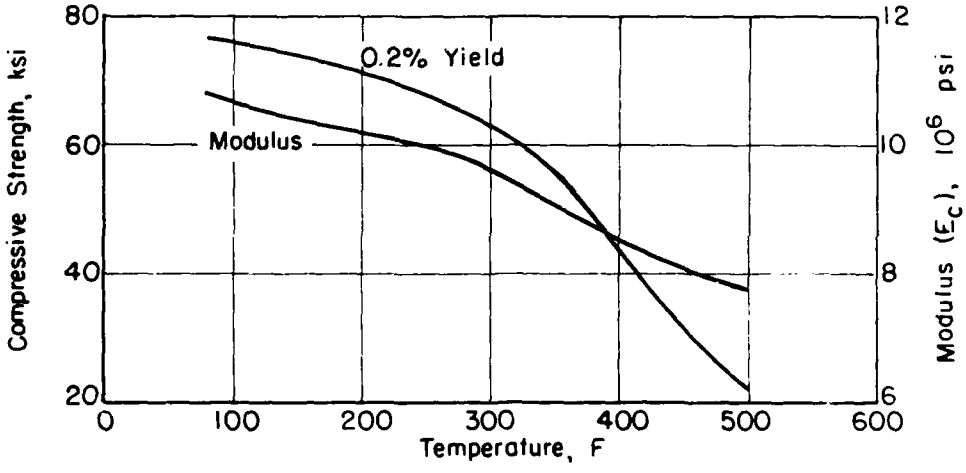

FIGURE 2. EFFECT OF TEMPERATURE ON THE COMPRESSIVE PROPERTIES OF 7175-T736 DIE FORGING

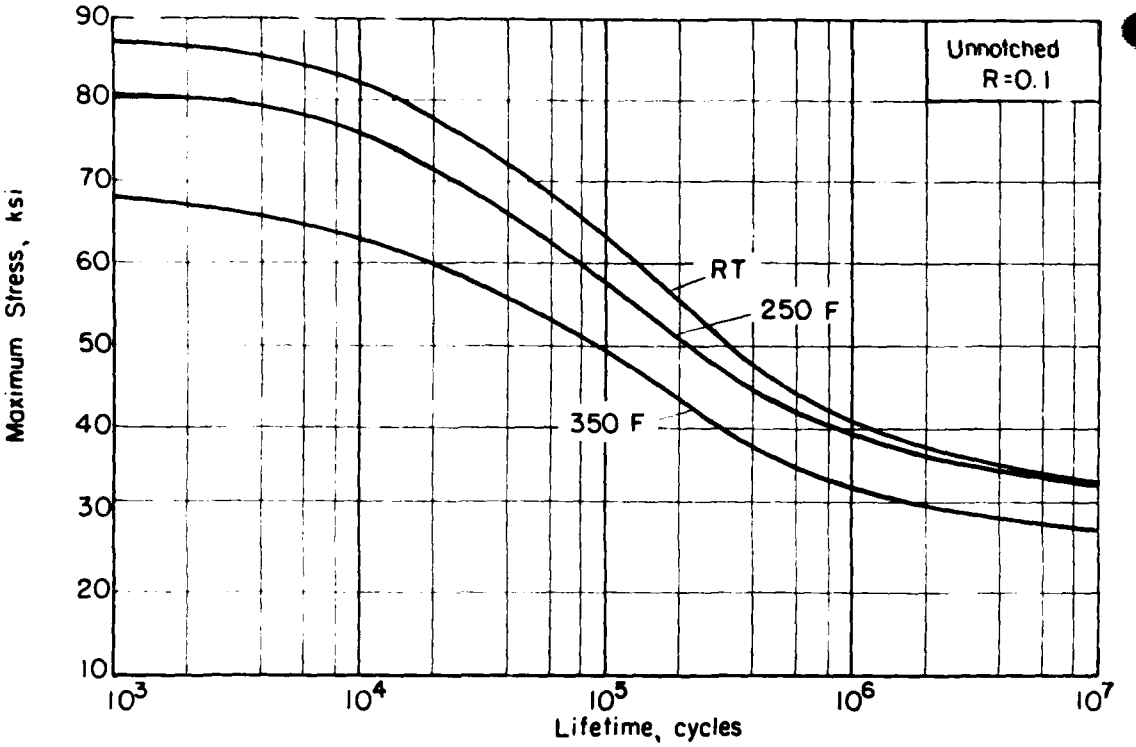

FIGURE 3. AXIAL LOAD FATIGUE RESULTS FOR 7175-T736 DIE FORGINGS AT THREE TEMPERATURES

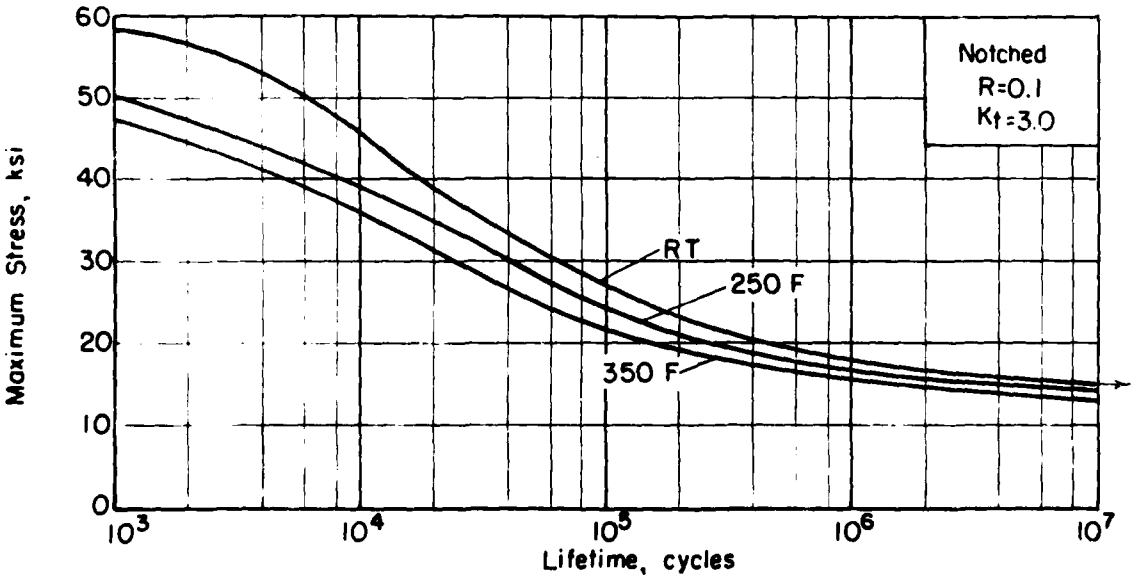

FIGURE 4. AXIAL LOAD LOAD FATIGUE RESULTS FOR NOTCHED (K_t=3.0) 7175-T736 DIE FORGINGS AT THREE TEMPERATURES

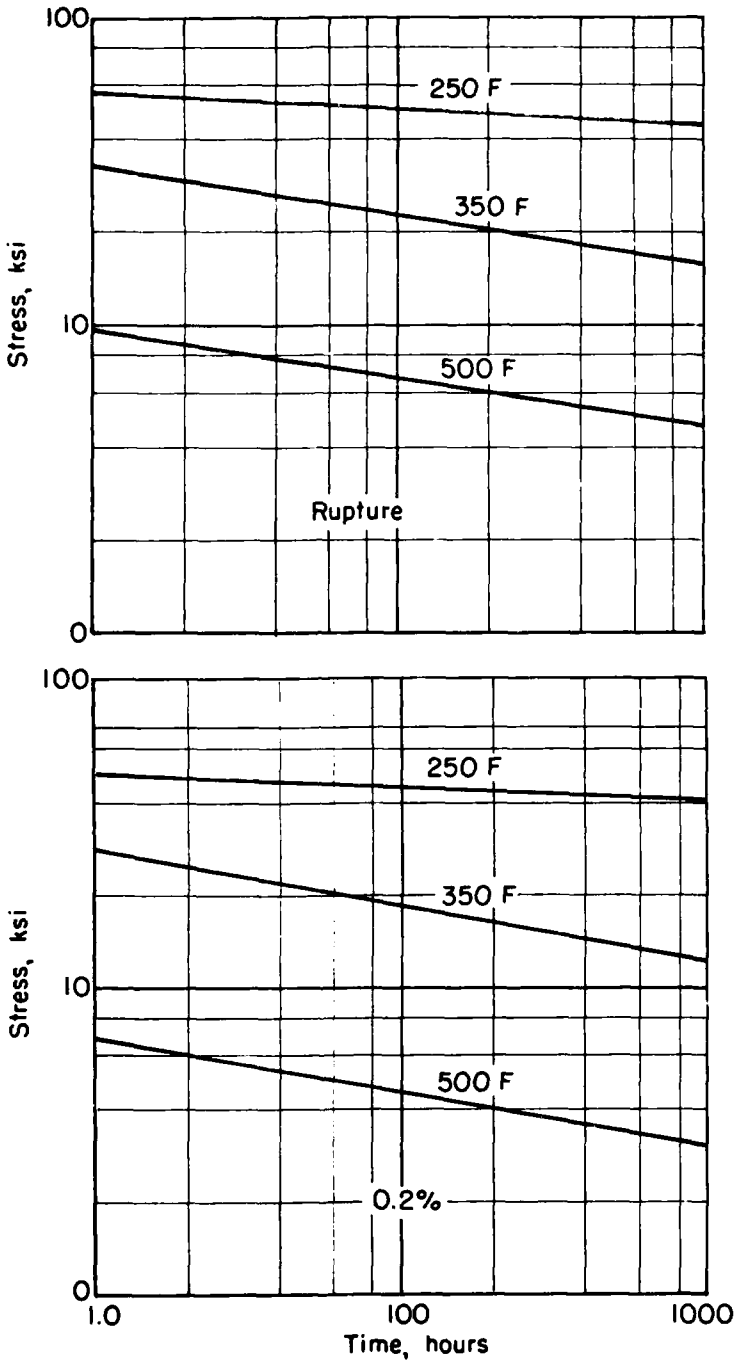

FIGURE 5. STRESS-RUPTURE AND PLASTIC DEFORMATION CURVES FOR 7175-T736 DIE FORGINGS